Optimization of reaction parameters of radiation induced grafting of 1-vinylimidazole onto poly(ethylene-co-tetraflouroethene) using response surface method

Abstract:

Radiation induced grafting of 1-vinylimidazole (1-VIm) onto poly(ethylene-co-tetraflouroethene) (ETFE) was investigated. The grafting parameters such as absorbed dose, monomer concentration, grafting time and temperature were optimized using response surface method (RSM). The Box–Behnken module available in the design expert software was used to investigate the effect of reaction conditions (independent parameters) varied in four levels on the degree of grafting (G%) (response parameter). The model yielded a polynomial equation that relates the linear, quadratic and interaction effects of the independent parameters to the response parameter. The analysis of variance (ANOVA) was used to evaluate the results of the model and detect the significant values for the independent parameters. The optimum parameters to achieve a maximum G% were found to be monomer concentration of 55 vol%, absorbed dose of 100 kGy, time in the range of 14–20 h and a temperature of 61 °C. Fourier transform infrared (FTIR), thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC) were used to investigate the properties of the obtained films and provide evidence for grafting.